

The Poultry Industry

An Overview from the Perspective of Agricultural Waste Management

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Introduction

Arkansas is the largest broiler producing state in the nation. Our state ranks 3rd in turkey production. We rank 6th in egg production. Most of the poultry production occurs in the western part of the state. Waste products from the poultry industry include litter (a mixture of bedding, manure, feathers, and spilled food), mortality, and poultry processing waste.

As far as manure production from confined operations is concerned, the poultry industry is the state's leader. Table 1 compares manure production from the major livestock operations in Arkansas. One of the important aspect of poultry litter is that it is collectable.

Table 1. Comparison of manure production from Arkansas animal waste operations.

	manure tons/year, dry matter basis	% of total manure	manure/litter (includes broiler & turkey litter) tons/year dry matter basis	% of total
broilers	900,000	27%	1,100,000	30%
layers	80,000	2%	80,000	2%
hatcheries	112,000	3%	112,000	3%
turkeys	224,000	7%	329,000	9%
total poultry	1,316,000	39%	1,621,000	44%
swine	110,000	3%	110,000	3%
dairy	156,000	5%	156,000	4%

cattle	1,811,000	53%	1,811,000	49%
total	3,393,000		3,698,000	

The information presented here shows that cattle manure constitutes 53% (on a dry-matter basis) of all of the manure generated by the four large livestock industries in Arkansas, although this resource has very low potential collectibility and usability. Broiler and turkey manure combined constitute 33% (dry matter basis) of the total amount of manure generated by the four industries, and is readily collectible and usable. Broiler and turkey litter combined constitute 39% (dry matter basis) of the total amount of manure generated by the four industries.

Current Poultry Litter Practices

Both broiler and turkey production require that a bedding material be spread over the floor of the poultry houses. Effective litter material must be absorbent, light, inexpensive, and non-toxic. It must also be compatible as a fertilizer or livestock feed after it has served its purpose as a bedding. The bedding serves the following functions:

- ✖ absorbs moisture and promotes drying by increasing the surface area of the house floor.
- ✖ dilutes fecal material, thus reducing contact between birds and manure.
- ✖ insulates chicks from the cooling effects of the ground and provides a protective cushion between the birds and the floor.

Litter quality has a lot to do with broiler production, in terms of performance. According to Michael P. Lacy, Extension Poultry Scientist at the University of Georgia,

Broilers do not perform to their genetic potential in a poor environment. The quality of the environment is highly dependent upon litter quality. The two factors that influence litter conditions most are manure and moisture. The manure portion cannot be controlled; however, growers can and must control litter moisture. Excess moisture in the litter increases the incidence of breast blisters, skin burns, scabby areas, bruising, condemnations and downgrades. Wet litter is also the primary cause of one of the most serious environmental factors affecting broiler production today -- ammonia.

Cleaning out the old litter and replacing it with new bedding material must be done periodically. The frequency with which clean-out occurs is often dictated by the integrator. It can vary from after every flock, to once a year, to even longer periods. Clean-out practices are tabulated in Table 2 for various regions in the U.S.

Table 2. Litter Practices: Percentage of Birds Raised Under a Particular Clean-out Schedule.

Number of flocks	Mid Atlantic	South Atlantic	South	SOUTH Central	North	National

1	14.3	29.4	1.1	2.7	0	8.8
2-3	2.3	28.8	18.6	12.4	21.8	14.5
4-5	0	22.2	20.2	0	0	7.0
6-7	0 1	6.4	30.5	84.8	78.2	49.8
8-15	45.5	0	29.6	0	0	12.8
Longer	22.2	0	0	0	0	3.8

Mid Atlantic States include: WV, DE, VA, MD, PA

South Atlantic states include: NC, SC, GA, FL

Southern states include: AL, MS, LA, TN

Central states include: AR, TX, MO, OK

Northern states include: OH, IN, IL, WI, MI, MN

There are many different materials that are used as bedding for poultry houses. Some of the various materials are given in Table 3 along with how they rank according to preference by companies in the poultry industry. Softwood shavings are the preference in most of the industry, but they have recently become very expensive, forcing a look at bedding alternatives. There is almost always a preference for materials that are locally available.

Table 3. Litter Ranking by Number of Companies Responding

Rank	Sawdust	Softwood shavings	Hardwood shavings	Peanut hulls	hull mix	Other
1	7	24	0	1	2	
2	12	8	4	1	1	Rice hulls (2)
3	3	0	5	0	0	Straw (2) Rice hulls (3) Peat moss
4	0	0	1	0	0	Straw (2) Paper Rice hulls Cardboard
5	2	0	0	0	0	Paper

Poultry Utilization

There are many ways to utilize poultry litter. The possibilities include land application to the soil as a conditioner and fertilizer; feeding it to animals as a protein supplement and source of nutrients; and composting it along with the poultry mortality, or some other waste material, and either spreading it on the land or processing it into a marketable yard product. There are other uses that are of minor importance, such as using it as the carrier material in the hydroseeding of disturbed land and in the production of *Crappy Critters*®, a house plant nutrient source made from poultry litter and packaged to sell in Wal Mart. Table 4 indicates the current use of poultry litter throughout the eastern part of the US.

Table 4. Manure Utilization: Percentage of Manure

	Mid Atlantic	South Atlantic	South	South Central	North	National
Land applied	82.6	94.6	89.3	92.4	86.2	90.5
Fed to animals	0	4.4	3.9	5.9	.5	4.2
Sold "as is"	3.3	.9	6.4	.8	13.3	2.3
Composted/ sold	1.3	0	.5	.9	0	.7
No estimate	7.8	0	0	0	0	1.3

Problems can arise from the application of poultry litter on pastureland. According to a recent extension publication:

Plant nutrients are so concentrated and readily available in poultry manure that crop yields can be reduced with heavy single applications and with excessive applications year after year on the same fields. The levels of nitrogen, phosphorus, and potassium in the soil can become excessive or out of balance with other plant nutrients. This imbalance can contribute to excessive vegetative growth, lodging, delayed crop maturity, poor quality of produce, and reduced crop yields. Even calcium deficiency in some vegetable crops can result from increased ammonium ion (NH_4^+) release.

Excessive soil potassium resulting from heavy or repeated yearly applications of poultry manure has reportedly caused soil salinity (excess soluble salts), a condition that retards seedling and crop growth and reduces yields. Salinity is most pronounced in sandy, droughty soils but also occurs in medium and fine-textured soils during prolonged dry spells. Too much soil potassium reduces the availability of magnesium to plants, thereby depressing both crop yield and crop quality.

Animal health problems arising from low levels of magnesium in the blood are directly associated with low levels of magnesium and improper potassium magnesium balance in the forages the animal eats.

Heavy manuring of the same field every year is undesirable. Guidelines for specific crop applications should be strictly observed. Manured soils should be soil tested at least every two years to avoid plant nutrient imbalances. Monitoring soil fertility is essential for continued normal crop yields, quality, and animal health.

When soil tests of manured fields show high phosphorus and potassium levels, the manure should be applied to less fertile fields or to rented land not usually manured. If all fields are already well manured, surplus manure may be sold. Alfalfa requires an ample supply of potassium and may therefore be planted to make the best use of excess soil potassium.

Applications that supply more nitrogen than crops require can increase nitrate levels in surface and ground water supplies and may also cause losses in crop yield and quality. Nutrient losses from poultry manure are reduced by storing manure dry and by incorporating it into the soil immediately after spreading. Poultry manure is not recommended for plants that do well on acid soils (e.g., blueberries). Applications to small grains should never exceed 1/2 ton dry matter per acre annually. Manure analysis is a good guide for determining the nutrient content of poultry manure.

Litter Production Rates

		avg. weight (b)	animal production life (c)	manure production rate (d)	moisture content of manure (e)	manure production factor (f)
poultry						
	broilers — manure	2	42	0.0800	75%	1.44
	broilers — litter	2	42	0.0350	24%	1.92
	hatcheries	4	365	0.0607	75%	22.10
	layers	4	365	0.0607	75%	22.10
	turkeys — manure	15	112	0.0436	75%	18.30
	turkeys — litter	15	112	0.0243	34%	26.90
(b)	average animal weight in pounds over the production life of the animal (= market weight/2).					
(c)	the duration, in days/year, that the animal is resident on the farm and produces manure;					
(d)	pounds manure / pound of animal / day.					
(e)	as excreted.					

(f)	the poultry production factor is calculated in pounds/bird;
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Litter Nutrient Analysis

The nutrient value of poultry litter varies with age, moisture, and litter content of the manure, the age and type of the bird, and the ration fed. It also varies according the number of flocks grown on it. The type of bedding material used makes very little difference, since most bedding materials are low in nutrients to begin with.

Chicken manure is about 75-80% moisture when voided. This can vary with health of the bird and amount of salt in the feed. Fresh manure dries rapidly if there is good ventilation through the house.

	Average Analysis (percent) Dry-Weight Basis	Range (Percent)	Average Nutrient Content (lb/ton) As-is Basis
Moisture	19.7	15 - 39	-
Nitrogen	3.9	2.1 - 6.0	62
Phosphate (P₂O₅)	3.7	1.4 - 8.9	59
Potash (K₂O)	2.5	0.8 - 6.2	40
Calcium (Ca)	2.2	0.8 - 6.1	35
Magnesium (Mg)	0.5	0.2 - 2.1	8
Sulfur (S)	0.4	.01 - 0.8	6
Total Digestible Nutrients	50.0	36 - 64	
Crude Protein	24.9	15 - 38	
Bound Nitrogen	15.0	5 - 64	
Crude Fiber	23.6	11 - 52	
Ash	24.7	9 - 54	

Feeding Poultry to Animals

Cattle and other ruminants can digest poultry litter. It is also an apparently palatable entrée that cows enjoy. In terms of the nutrients that litter provides, it is more cost effective to use it as a feed supplement than as a fertilizer. According to Ruffin and McCaskey, poultry litter is worth about four times more as a feed supplement than it is as a fertilizer. Litter is a good source of protein, energy, and minerals.

Broiler litter has been used as a cattle feed for several decades without any recorded effects on humans who have consumed the animal products. In 1967, FDA issued a policy statement advising against the use of any kind of animal waste as a feed. Following extensive research at universities and USDA facilities, the FDA rescinded the policy.

Processing of broiler litter can be done in a number of ways including:

- ✱ ensiling
- ✱ acidification
- ✱ mechanical drying or pelletizing
- ✱ deep stacking - at least 20 days to allow center temperatures to reach 130 °F.

Good quality poultry litter has an ash content less than 28%, has been deep stacked or otherwise processed to kill pathogenic organisms, has not over heated. (This causes more of the nitrogen to become bound. Not more than 25% of the crude protein should be bound or insoluble.), and should have a crude protein content of greater than 18%.

Poultry Mortality

Disposal pits tend to contaminate the ground water table and since about 1993, they have been against the law.

Incineration is an expensive option, since gas has to be burned in the incinerator to obtain temperatures high enough to burn up the birds.

Composting the mortality is becoming more popular in many places, since the dead birds are converted to a stable substance that has fertilizer value. Using Compost that was made from mortality as a feed for animals is not currently recommended.

Tyson has recently started providing the growers with freezers that look similar to dumpsters. The dead birds are frozen and picked up periodically by trucks from the rendering plants. This is convenient for the farmer and lucrative for the integrator.

Ensiling dead birds by grinding the carcasses, adding a carbohydrate source, and allowing to ferment is another method of storage while awaiting transport to the rendering plant. Lactobacilli acidify the mixture, preventing further decomposition of the birds.

Use of Hardwood Materials as Bedding

The use of hardwood sawdust and shavings as poultry house bedding material has been implicated in the occurrence of aspergillosis, a respiratory infection brought on by the inhalation of airborne spores produced by aspergillus fungus. For some reason, pine material has something in it that appears to lessen the probability of this severe stunting and mortality causing disease. However, there are many producers using the material without associated problem. It is likely that the problem is directly influenced by litter moisture, and where good ventilation keeps the litter dry, aspergillosis does not occur.

Manure Management Plan

To maximize the nutrients in poultry litter as well as to protect water quality, a manure management plan should be developed. Although not required under current regulation, a voluntary plan should be developed for each field in which litter will be applied. Several steps are necessary to formulate a sound plan:

1. Recognize animal manure as a valuable resource and manage it accordingly.
2. Soil test to determine current nutrient status of a field and to indicate future nutrient needs.
3. Analyze manures to determine nutrient status of the material to be applied.
4. Consider a water test to determine if a problem exists with nitrate or phosphate contamination.
5. Apply manure according to crop needs, current soil tests and physical properties of the soil.

Best Management Practices for Using Poultry Litter as a Fertilizer

1. Evenly distribute poultry litter over the application site at a rate not to exceed 5 tons per acre per year with no more than 2.5 tons per acre in each application.
2. Land application of poultry litter should not be made when the soil is saturated, frozen or covered with snow, during rainy weather or when precipitation is in the immediate forecast.
3. Poultry litter should not be applied to slopes with a grade of more than 15 percent or in any manner that would allow manure to enter water sources.
4. Surface application of poultry litter should not be made within 25 feet of rock outcrops and 100 feet of streams, ponds, lakes, springs, sinkholes, wells, water supplies and dwellings.
5. Keep records of the dates, amounts and specific sites where you apply litter. If you sell litter, keep a record of who buys the litter, the dates and amounts sold.
6. Cover or tarp vehicles if you transport poultry litter on state or federally maintained roads or any public road for more than one mile

7. Develop a good relationship with the surrounding community. Avoid spreading litter during times when it would be most objectionable to your neighbors. Refrain from spreading the day before holidays or weekends to minimize conflicts.